

Attorney Docket No.: 351913-992740

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A non-volatile memory cell comprising:
a substantially single crystalline substrate of a first conductivity type having a planar surface;
a trench in said planar surface, said trench having a side wall and a bottom;
a floating gate in said trench spaced apart and insulated from said sidewall and from said bottom; said floating gate having a tip away from said bottom;
a first region of a second conductivity type in said bottom;
a second region of a second conductivity type along said planar surface, spaced apart from said first region;
a channel region between said first region and said second region, said channel region only along said sidewall, said floating gate spaced apart and along said entire channel region;
a control gate, positioned above the planar surface, capacitively coupled to said floating gate and capable of effecting erase; and
a tunnel material between said tip and said control gate, wherein said tunnel material is a tunnel oxide and configured to permit Fowler-Nordheim tunneling of charges from said floating gate to said control gate.

Claim 2-3 (canceled)

Claim 4 (original): The memory cell of claim 1 further comprising an insulation material between said floating gate and said sidewall of said trench, said insulation material permitting injection of hot channel electrons from said channel region to said floating gate.

Claim 5 (currently amended): An array of non-volatile memory cells in a substantially single crystalline substrate of a first conductivity type having a planar surface, said array comprising:

a plurality of discontinuous trenches in said planar surface, spaced apart and

Attorney Docket No.: 351913-992740

substantially parallel to one another extending in a first direction; each of said discontinuous trenches having two sidewalls and a bottom and being discontinuous in said first direction by a plurality of isolations, each of said discontinuous trenches having a plurality of sections separated by an isolation;

a first floating gate in each trench spaced apart and insulated from a first sidewall and from said bottom; said first floating gate having a tip away from said bottom;

a second floating gate in each trench spaced apart and insulated from a second sidewall and from said bottom; said second floating gate having a tip away from said bottom;

a first region of a second conductivity type in said bottom of each trench;

a second region of said second conductivity type along said planar surface;

a channel region between each of said first region and said second region, said channel region only along said first and second sidewall;

a first contact in a first trench electrically connected to said first region of a first section and passing an adjacent isolation and electrically connected to said first region of a second section of said first trench, said first contact between a pair of floating gates and insulated therefrom;

a plurality of control gates, each control gate extending in a second direction, substantially perpendicular to said first direction, extending over a plurality of tips of a plurality of floating gates and insulated therefrom; and

a tunnel material between said plurality of tips and said control gate, wherein said tunnel material is a tunnel oxide and configured to permit Fowler-Nordheim tunneling of charges from said floating gate to said control gate.

Claim 6-7 (canceled)

Claim 8 (original): The array of claim 5 further comprising an insulation material between said first floating gate and said first sidewall of said trench, said insulation material permitting injection of hot channel electrons from said channel region to said first floating gate.

Claim 9 (previously amended): The array of claim 8 further comprising said insulation material between said second floating gate and said second sidewall of said trench, said insulation material permitting injection of hot channel electrons from said channel region to said second floating gate.

Attorney Docket No.: 351913-992740

Claim 10 (currently amended): A non-volatile memory device in a substantially single crystalline substrate of a first conductivity type having a planar surface, said device comprising:

- an array of non-volatile memory cells arranged in a plurality of rows and columns; wherein each cell comprising:
 - a trench in said planar surface, said trench having a side wall and a bottom;
 - a floating gate in said trench spaced apart and insulated from said sidewall and from said bottom; said floating gate having a tip away from said bottom;
 - a first region of a second conductivity type in said bottom;
 - a second region of a second conductivity type along said planar surface, spaced apart from said first region;
 - a channel region between said first region and said second region, said channel region only along said sidewall;
 - a control gate, above said substrate, spaced apart from said tip and capacitively coupled to said tip; and
 - a tunnel material between said tip and said control gate, wherein said tunnel material is a tunnel oxide configured to permit Fowler-Nordheim tunneling of charges from said floating gate to said control gate; and
- wherein cells in adjacent columns share a common trench to one side and a common second region to another side;
- wherein cells in adjacent rows are separated by an isolation row and wherein said second region in one row is connected to said second region of another row;
- wherein a first cell in a first row includes a first contact in said trench electrically connected to said first region of said first cell and wherein said first contact is electrically connected to said first region of a second cell in a second row separated from said first row by at least one isolation row; and
- wherein said control gate of cells in the same row are connected together.

Claim 11 (original): The device of claim 10 wherein a control gate extends over a plurality of rows.

Attorney Docket No.: 351913-992740

Claims 12-13 (canceled)

Claim 14 (original): The array of claim 11 further comprising an insulation material between said first floating gate and said first sidewall of said trench, said insulation material permitting injection of hot channel electrons from said channel region to said first floating gate.

Claim 15 (previously amended): The array of claim 14 further comprising said insulation material between said second floating gate and said second sidewall of said trench, said insulation material permitting injection of hot channel electrons from said channel region to said second floating gate.

Claim 16 (currently amended): A non-volatile memory device comprising:
a plurality of non-volatile memory cells arranged in a plurality of rows and columns; each cell having a first terminal, in a trench, and a second terminal, not in a trench, with a channel region therebetween only along a sidewall of the trench, a floating gate spaced apart and insulated from said channel region along said sidewall of the trench, a control gate capacitively coupled with said floating gate, and a tunnel material between said floating gate and said control gate configured to permit Fowler-Nordheim tunneling of charges from said floating gate to said control gate to effect erasure; a coupling gate, in the trench, capacitively coupled to the floating gate and electrically connected to said first terminal;

wherein said cells in the same row are connected with each cell having a common second terminal with an adjacent cell to one side, and having a common first terminal and a common coupling gate with an adjacent cell to another side;

wherein cells in the same row have the control gate connected together; and

wherein cells in adjacent rows are separated by isolation.

Claim 17 (cancelled)

Claim 18 (original): The device of claim 16 wherein said floating gate of cells in the same row are capacitively coupled to the same control gate.

Claim 19 (original): The device of claim 16 wherein cells in the same column have the same first terminal and the same second terminal.

Attorney Docket No.: 351913-992740

Claim 20 -24 (cancelled).

Claim 25 (New) The memory cell of claim 1, further comprising:
an assist gate in the trench, connected to the first region, and capacitively coupled to the floating gate.

Claim 26 (New) The memory cell of claim 25 wherein the assist gate is substantially parallel to the floating gate and insulated therefrom.